What is claimed is:

1. A method for optically inspecting a sample, the method comprising:

illuminating the sample with a probe beam;

measuring the diffraction resulting from the interaction of the probe beam and the sample;

defining a model of the sample, the model including a first series of three-dimensional shapes that define the edge of a line within the sample;

evaluating the model in three dimensions to predict the diffraction resulting from the interaction of the probe beam and the sample; and

adjusting and reevaluating the model to minimize the difference between the predicted and measured data.

2. A method as recited in claim 1 in which the three-dimensional shapes represent mesas on the surface of the sample.

3. A method as recited in claim 2 in which the mesas are shaped as cylindrical or conical projections from the sample surface with the projections having circular or elliptical cross-sections.

4. A method as recited in claim 1 in which the three-dimensional shapes represent holes in the surface of the sample.

5. A method as recited in claim 4 in which the holes are shaped as cylindrical or conical voids in the sample surface with the voids having circular or elliptical cross-sections.

6. A method as recited in claim 1 in which the model includes a second series of three-dimensional shapes that refines the definition of the line edge within the sample.

7. A method as recited in claim 6 in which the first series and second series of three-dimensional shapes differ in shape size, pitch or phase.

8. A method of evaluating the roughness of a line edge on a wafer comprising the steps of:

obtaining optical measurement data from the wafer;

comparing the measured data to calculated data, the calculated data based on a model that includes the scattering effects from an array of holes or mesas and wherein the spacing between the holes or mesas in the models is selected so that the holes or mesas overlap to approximate an undulating edge; and

adjusting the model to minimize the difference between the calculated and measured data.

9. A method as recited in claim 8 in which the mesas are shaped as cylindrical or conical projections from the sample surface with the projections having circular or elliptical cross-sections.

10. A method as recited in claim 8 in which the holes are shaped as cylindrical or conical voids in the sample surface with the voids having circular or elliptical cross-sections.

11. A method as recited in claim 8 in which the array of holes or mesas includes a first series of holes or mesas and a second series of holes or mesas in which the first series and second series differ size, pitch or phase of the mesas or holes.

12. A method for optically inspecting a sample, the method comprising:

illuminating the sample with a probe beam;

measuring the diffraction resulting from the interaction of the probe beam and the sample;

defining a model of the sample, the model including at least one line having a width defined to vary over the length of the line;

evaluating the model in three dimensions to predict the diffraction resulting from the interaction of the probe beam and the sample; and

adjusting and reevaluating the model to minimize the difference between the predicted and measured data.

13. A method as recited in claim 12 in which the line width is defined in terms of one or more periodic functions.

14. A method as recited in claim 13 in which the periodic functions differ in amplitude, frequency or phase.

15. An apparatus for evaluating a wafer having one or more lines formed on the surface thereof comprising:

a light source for generating a probe beam;

a detector for detecting light from the probe beam diffracted from the wafer and generating measurement signals; and

a processor for comparing the measurement signals to theoretical data, said theoretical data being generated using a model of the sample, said model including a representation of a line having edge roughness, said representation being based on a series of overlapping three-dimensional geometrical features.

16. An apparatus as recited in claim 15 wherein the measurement signals are compared to a data base of theoretical data generated using a parametized model.

17. An apparatus as recited in claim 15 wherein said processor iteratively adjusts the model so that the differences between the theoretical data and the measurement signals are minimized.

18. An apparatus as recited in claim 15 wherein said light source is broadband and the detection means generates measurement signals as a function of wavelength.

19. An apparatus as recited in claim 18 wherein the apparatus includes a spectrometer.

20. An apparatus as recited in claim 18 wherein the apparatus includes an ellipsometer.

21. An apparatus as recited in claim 15 in which the three-dimensional features represent mesas on the surface of the wafer.

22. An apparatus as recited in claim 21 in which the mesas are shaped as cylindrical or conical projections from the sample surface with the projections having circular or elliptical cross-sections.

21. An apparatus as recited in claim 15 in which the three-dimensional features represent holes in the surface of the sample.

22. An apparatus as recited in claim 21 in which the holes are shaped as cylindrical or conical voids in the sample surface with the voids having circular or elliptical cross-sections.

23. An apparatus for evaluating a wafer having one or more lines formed on the surface thereof comprising:

a light source for generating a probe beam;

a detector for detecting light from the probe beam diffracted from the wafer and generating measurement signals; and

a processor for comparing the measurement signals to theoretical data, said theoretical data being generated using a model of the sample, said model including a representation of a line having edge roughness, said representation being based on a line having a width which varies over the length thereof and being defined by a superposition of periodic functions.